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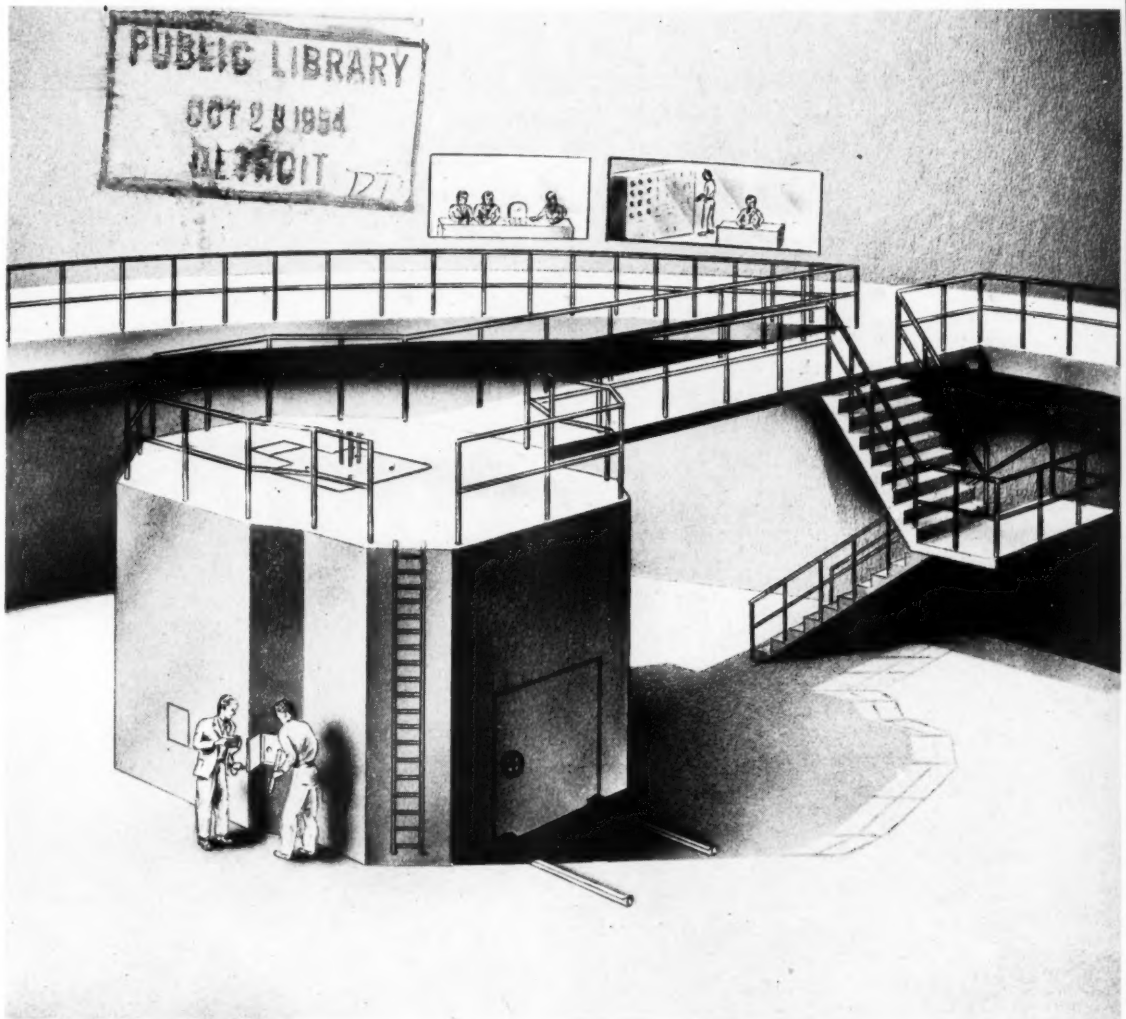

WESTERN SOCIETY OF ENGINEERS FOUNDED 1869

WHAT CONSTRUCTION MEANS TO AMERICA—PAGE THREE

WSE MEETINGS—PAGE TWO

Vol. 7 OCTOBER, 1954 No. 5

Western Society of Engineers
84 E. Randolph St.

KICK-OFF PARTY

November 5, 1954

Another one of those outstanding social events for you and your lady (or for our lady members and their male guests) featuring:

1. **AT 6:00 P.M. SOCIAL HOUR** in the lounge with a reception for our new officers, directors and committee chairmen.

2. **AT 7:00 P.M. DELUXE WSE DINNER** with all the trimmings. (Please note on the reservation coupon whether you want meat or fish.)

3. **AT 8:00 P.M. ENTERTAINMENT BY PAUL MEEKER** and his nationally famous Drake Hotel orchestra and a crew of specialists. Our members are still talking about the wonderful evening he gave us in October, 1953. — So he is back by popular request.

4. **DANCING.** After the entertainment there will be dancing to just the kind of music **you** like played by Paul Meeker and his gang.

And here's the best part of this big evening — the price will be **ONLY $4.50** per person—but be sure to fill out the reservation form and mail it in with your check.

You can specify a table for six, eight or ten, or you and your partner can come as a two-some and you will be seated with some of the most delightful people you ever met.

Everyone will have a table assignment so you can feel free to linger at the social hour and still be sure of good seating.

We are going to have to limit our reservations, so don't hold back. Plan now for this wonderful evening.

Your Special Events Committee is planning four big parties for the coming season —so mark up these dates on your calendar:

Nov. 5, 1954
Jan. 14, 1955
March 4, 1955
April 29, 1955

Western Society of Engineers
84 E. Randolph St.,
Chicago, Illinois

Attached is my check for $_____ covering _____ seats at $4.50 each for the big Kick-Off party.

Name (Please Print) _____

Street _____

Zone _____ City _____

Tickets are to be mailed to me ☐ Please hold tickets at door ☐
Please check whether you wish meat ☐ fish ☐

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OCTOBER, 1954 Vol. 7, No. 5

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COVER STORY

First nuclear reactor for industrial research will be established at Armour Research Foundation of Illinois Institute of Technology, Chicago. A highly flexible research tool for exploiting radiations, the reactor is designed for ultimate operation of 50,000 watts or higher. Artist's conception shows interior of reactor room adjacent to laboratories for handling radioactive material.

October 25, WSE General Program

Speaker: Dr. Stuart McLain, program coordinator, Argonne National Laboratories.

Subject: "Industrial Uses of Atomic Energy." Atomic energy makes the headlines of our newspapers every day. We know that great things are happening in that field of engineering and science. But, what is the real status of atomic energy today? Don't miss this chance to find out.

October 27, Noon Luncheon Meeting

Speaker: Dr. Robert N. McMurry, McMurry, Hamstra & Co., consulting industrial psychologists.

Subject: "Executive Neurosis." Here is one luncheon meeting you cannot afford to miss! Most engineers, being executives or potential executives, face the stress of more complexing problems than do most other persons in business and industry. It is therefore important for them to know as much as possible about the different forms, good and bad, that reactions to stress can take. You should know what actually causes the reactions. You should know how to recognize the undesirable ones. And most important of all, you should know how to prevent those crippling reactions—neuroses. The information you receive at this meeting may be some of the most important you will ever get. It may spell the difference between a fairly successful engineering career and a decidedly successful one. Really, can you afford to miss this opportunity?

October 27, Bridge and Structural Engineering Section

Speaker: Seth Gooder, retired shoring contractor, Gooder-Hendrichsen Co.

Subject: "Landing and Moving the U-505." Mr. Gooder, chairman of moving and construction operations for the captured submarine, will relate his experiences in connection with this once-in-a-lifetime project. Pictures will enhance this story about Chicago's pet project.

November 1, Gas, Fuels, and Combustion Engineering Section

Speaker: T. J. Calabrese, Minneapolis-Honeywell Regulator Co.

Subject: "Control of Combustion in Industrial Applications." Mr. Calabrese's talk will be a general discussion of the subject with particular emphasis on safety, Underwriters' and insurance requirements.

November 3, Noon Luncheon Meeting

Speaker: F. K. Mansfield, director of service engineering, Chicago Aerial Survey Co.

Subject: "Planning from Pictures." The importance of surveys made from the air is growing rapidly. Therefore you will find the methods and applications discussed at this meeting of ever-increasing value. Pictures, charts, and maps will be used.

November 5, Kick-Off Party

See inside the front cover of this issue for all information.

November 10, Noon Luncheon Meeting

Speaker: L. E. Kearney, communications engineer, Association of American Railroads.

Subject: "The Radio in Railroad Communications." The use of the radio in transportation has not attracted as much attention in the American scene as its importance deserves. At this meeting you will hear of some startling uses of modern radio in railroading.

November 15, Electrical Engineering Section Meeting

Speaker: John R. Conrad, president, S & C Electric Co.

Subject: "News in Metal-Clad Circuit Interrupting Equipment." Mr. Conrad's presentation will cover the evolution, fundamentals, design, and potential applications of this equipment. It brings a completely enclosed distribution substation to electric utilities for serving large cities. It also saves space and switching facilities, and allows industrial establishments to install high-voltage systems with smaller outlays of capital.

NOTICE

Have you sent in your dues? If not, you have probably just overlooked doing so. While the subject is fresh on your mind, now is a good time to write and mail your check to Western Society of Engineers, 84 East Randolph Street, Chicago 1, Ill.

What Construction Means to America

by Willard Chevalier

To answer adequately the question implied by the subject of this talk, "What does construction mean to America?", we must view construction in its three distinct aspects.

The first and most obvious of these aspects is revealed in its product, the vast diversity of works and structures that it contributes to American life.

The second is its aspect as an industry in its own right, an aggregation of men, equipment, tools and all the necessary operating paraphernalia assembled in effective organizations under competent management.

The third is its aspect as a dynamic factor in the national economy, exerting its influence on the cycle that affects and reflects the economic well-being of the nation as a whole.

What construction means to America, then, is the combined effect of all these. Obviously, it is possible, within the time available here this morning, to present only a hill-top view of this vast operation known as "construction," and briefly to appraise its significance in the national scene.

The Product of Construction

Considering construction in the first of these three aspects, it has been defined as the process by which man adapts his physical environment to his needs. Probably America is the pre-eminent example of this process in its most intensive form. Within the short span of four or five generations, half a continent has been transformed from a wilderness into a nation of 160 million people. Moreover, during this period, these people have created an environment within which they can enjoy a living standard unparalleled in history. In this country, less than 7 per cent of the population of the world, living on 6 per cent of the land area, produces nearly half of the world's income.

Let me, at this point, emphasize that we are talking about a material standard of living. It is not to be confused with those intellectual and spiritual standards, which may or may not accompany a high material standard of living. It is a capital mistake to assume, as we often do, that an abundance of material wealth will insure a high standard of human happiness or intellectual progress. But that is outside the scope of this discussion, and I mention it here only to make clear that construction is primarily a servant of our material progress.

All the fixed physical plant and facilities that make possible our high living standards are the produce of construction. The log cabins built by the pioneers, the wells that they dug and the trails that they hewed out of the forests were its first fruits. Over a century and a half, these primitive facilities have been so increased in variety, in size, and in cost that they now include all the amazing fixed plants of our industry, commerce and community life. They are embodied in our dwellings and business buildings, mines and factories, far-flung highway and railroad networks, dams, airports, tunnels, sanitary installations, irrigation and flood-control facilities.

The Rise of the Specialist

This constant growth in the diversity and size of our structures has of necessity developed specialists in their design, construction and operation. These have long since taken over the tasks once performed by the pioneers, each of whom provided his own facilities. One compelling reason for this specialization was the unceasing extension of our scientific frontiers. Out of this came the development of new materials, techniques, equipment, structures and other facilities required to render an ever higher degree of service and satisfaction.

Coupled with this scientific progress was the insatiable drive of the class-free American to have more and enjoy more of the world's goods, his adventurous willingness to try new products and methods, his open-minded reception of the salesmen who pursued him in behalf of those producers and merchants who offered him something new or something better.

And above all, there beckoned always the geographical frontiers of a new nation, moving steadily westward as each successive surge revealed new challenges, new opportunities and new wealth for those who dared to face and grasp them.

Pioneers amongst these technical specialists were the civil engineer, the architect and the mining engineer. As requirements increased and mechanical power became available, more specialized help was provided by the mechanical and electrical engineers. And after them came the chemical engineer and a host of other even more highly specialized technicians.

The civil engineer and the architect design the fixed facilities that compose the nation's physical plant; the mechanical and electrical engineers animate them for usefulness; the mining and chemical engineers provide the materials required for the entire process.

It is the peculiar function of construction to realize the designs of the engineers: i.e., to assemble the labor, materials, equipment and the specialized skills and management required to convert those designs into the fixed structures and facilities that we see about us.

The Community Services

As one measure of the task performed by the construction industry in building the America that we know, let us take a quick look at some of the essential services it provides to make community living possible and to make our people more productive and efficient.

Water Supply

In 1850, a century ago, there were only about 100 water works in the United States. In 1885, there were about 1,000;in 1895, about 3,000; and in 1924, about 9,000. Today, there are perhaps 12,000.

Mr. Chevalier, executive vice-president, McGraw-Hill Publishing Company, presented this talk before the Symposium on Structures and Construction of the Centennial of Engineering in Chicago, Sept. 8, 1952. His talk is used by permission of the Centennial of Engineering, the collected talks of which are available in bound form from the Centennial, Museum of Science and Industry, Chicago.

Less important, however, than the number, is the improved quality of the water supplied to our communities. When filtration was introduced early in the century in Philadelphia, the number of typhoid cases dropped within less than five years from over 600 per 100,000 to less than 100, and within the next twenty years to practically none. Typhoid deaths traceable to water supplies are practically unheard of in America today. Other water-borne diseases also are rapidly disappearing.

As the cities outgrew their near-by water sources, it became necessary for them to seek farther and farther afield to find adequate supplies of pure water. New York City draws Delaware River water through the world's longest tunnel, 85 miles in length. Los Angeles taps the Colorado River 400 miles away. Denver brings its water from the other side of the Continental Divide.

Sewage Disposal

But increasing consumption of water by our cities and towns made necessary corresponding improvement of their facilities for sewage disposal. In the early days, most raw sewage was dumped in the nearby streams. But these eventually were needed to supply pure water for other communities. It was in 1886 that the Lawrence, Massachusetts, Experiment Station marked the beginning of advanced sewage disposal practice in the United States. Today, while there is still room for more improvement, modern sanitation has made city living safer and more healthful than in many rural communities.

Transportation

Scarcely less vital is the matter of transportation. Residents of the modern city must be able to get to their work and home again, and their food and other supplies must be conveyed to convenient points of wholesale and retail distribution. Early in our urban development, the horse-drawn conveyance gave way to the electric street-car. Later, the street-car, with its tracks built into the pavements, gave way to the bus. In some of the larger communities, speedy long-distance transportation was forced overhead or underground on rapid transit railroads. And as the individual motor car achieved all but universal acceptance, it became necessary to build express-ways through and around our cities. The first of these appeared in St. Louis in 1936.

As efficient transportation is necessary to the functioning of each single community, it was equally essential to provide transportation for freight as well as passengers between communities and to every region of an expanding country. Its first expression was through turnpikes and Conestoga wagons, then through canals. The first half of the century that we celebrate was the great railroad building era which first connected the inland regions with the eastern seaboard, and then tied together the Atlantic and the Pacific regions into one nation. Next, the motorcar brought the roads, and better roads fostered the expanding use of more motorcars. By the time the railroads had finished their building, they had spread a net of some 224,000 miles of line across the country. Today, this is supplemented by 3,000,000 miles of highways, some of them six and eight lane free-ways, that frequently cost a million dollars a mile to construct, and sometimes as much as five million dollars.

Reclamation and Flood Control

As the railroads and the highways opened up new land, there arose a greater demand for reclaiming large areas from desert and marsh. In 1902, a national reclamation act was passed, and then we entered a half-century period of dam and reservoir building to impound the waters needed by the new land. All these required their quotas of canal and pumping plant construction.

As the early settlements, first located in the river valleys, were developed into great cities and fertile farm-lands, the problem of flood control raised its head. Man-made facilities had encroached on the flood plains and flood damage became a substantial item in the national economy. Levees were built to confine the streams. More frequently than not, they failed to curb the peak flood flows. This in turn made it desirable to build dams to hold back some of the flood flow.

As reclamation and flood control dams harnessed more and more of our streams, the possibilities of using their impounded waters to generate electric power were widely preached. Soon this became as important a factor in river controls as flood prevention or irrigation.

Construction as an Industry

All these services and facilities and many more were the products of construction. They either created new wealth or conserved wealth already in being. Thus, an America, dependent on construction to provide the physical facilities essential to its growth, nourished a construction industry of unprecedented skill and capacity.

Thus, we come to construction in its second aspect: what are the dimensions of this industry which performs this vital function of providing and keeping up to date the physical plant that contributes so much to our material and economic progress?

As of 1951, the three largest industries in the American economy were (1) metal-working in all its branches, (2) manufactured foods and beverages, and (3) construction. The total output of our economy in 1951 was $329 billion, and construction accounted for $40.5

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General Contractors

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billion or 12.3 per cent. Of this 12.3 per cent, 9.4 per cent went for new construction and 2.9 per cent for maintenance and repair.

Construction, then, is a vast enterprise in itself. It is a large share of the national effort to be devoted consistently to the expansion and improvement of the fixed plant and facilities required by industry, commerce and community life.

The established contractors and speculative builders of America include some 245,000 private businesses, ranging from very small to very large. From their nature, construction operations must be performed at the site of the project. No substantial part of the total ever can be concentrated under one roof or in one city. Thus, the construction industry is and must remain a dispersed industry, a stronghold of competitive effort and of individual free enterprise.

Of these 245,000 firms, some 7,000 go in for the large projects of heavy construction. About 38,000 erect buildings either as contractors or as speculative or owner-builders for sale or rent. The remaining 200,000 are special trades contractors or subcontractors for specialized segments of the construction process.

Employed in the construction industry are more than three million workers, which is nearly 5½ per cent of all our employment. As a gauge of the capital invested in the industry, the value of construction equipment alone aggregates more than $4 billion.

Contrary to the impression held by many uninformed people, the construction industry is not a happy hunting ground for fly-by-night operators. Any industry that must operate on a job-to-job basis, that is highly competitive, that must frequently get its jobs by open bidding, and that is composed of a large number of small specialized units, will, from its nature, be subject to a greater turnover than a more stable, fixed industry such as manufacturing.

Despite that, however, some of the largest contracting firms in this country have been in business for many years. One of the largest has been in operation almost a century and a quarter. Many, from small beginnings, have grown into great operations. One of these companies in its first year, 1912, handled $75,000 worth of work. In 1951, its 40th year, the same company completed work valued at $312 million dollars, of which $82 million was in foreign countries.

But many of the very large construction projects of our time have outgrown in size and financial risk the capacity of the single construction company. In reply to this challenge, the industry has devised a flexible system of joint ventures whereby several companies pool their technical brains, their capital, and their equipment to bid on a particular job and carry it through to completion. The Grand Coulee Dam, greatest concrete dam in the world, is an example of such a project, involving the cooperation of ten companies, from six states, and each company a large operator in its own right.

It is estimated that the construction industry employs in its regular plant more than two million pieces of heavy equipment. For example, it uses in the United States alone something like 900,000 trucks, 245,000 tractors, 130,000 pumps, 120,000 concrete mixers, 78,000 motor graders, 47,000 heavy duty power shovels and cranes, and 42,000 air compressors. And in addition, of course, the construction industry buys, handles and installs more than 200 million barrels of cement, nearly three million tons of fabricated structural steel, brick in the billions of units, and lumber in the billions of board feet.

At this time, known projects, proposed for future construction, top $65.3 billion, exclusive of housing and smaller local projects. This is only a quarter of the estimated need for public and private heavy construction during the

(Continued on Page 11)

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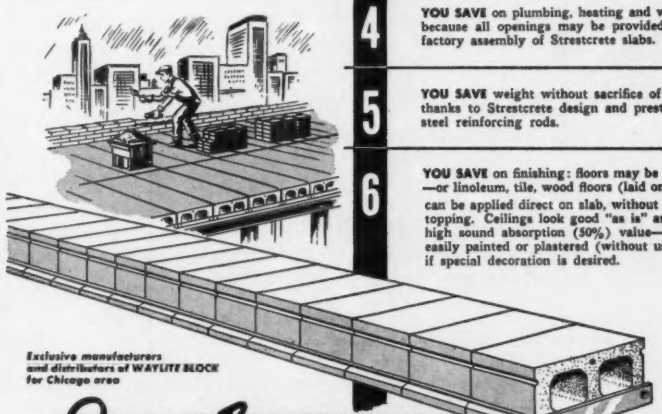

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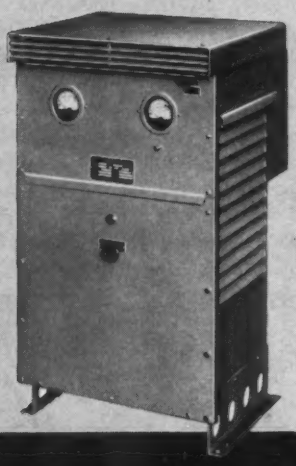

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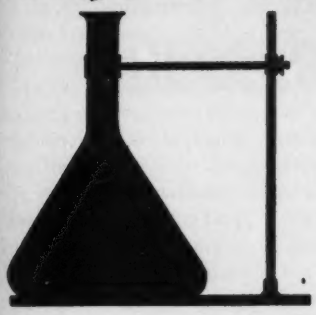

By

M. LELYN BRANIN

Recent cuts in the Federal Synthetic Fuels budget have not brought an end to research in this important future coal market. In fact, private industry has speeded its work and expanded its facilities for the development of liquid fuels and chemicals from coal. Here is a summary of the work being done in this field and some predictions as to the future of this coal application.

Ever since World War II, the petroleum question has been a vital issue in national planning. The reason for this is that liquid fuel consumption in the U. S. has expanded at a rate far beyond anything that was anticipated ten or fifteen years ago; and in spite of the fact that production of domestic crude has been steadily increasing, it has not kept pace with demand. It is generally known that present civilian and military needs are not being met wholly from domestic production. To satisfy this deficit, the U. S. has turned to importing somewhat cheaper foreign oil, some of which has been poured into this country in sufficient quantities to give serious competition to coal in the industrial and residential heating-fuel markets. Efforts to have Congress limit the amount of foreign oil, especially residuals, that may be imported in any one calendar year have proved thus far to be unsuccessful. Whether any action will be taken at the forthcoming session of Congress remains a moot question. Another effect of this importation of foreign oil has been to lessen the incentive for the production of synthetic liquid fuels from the vast reserves of oil shale, coal and lignite that are readily available in this country, since at the present time it is cheaper to import oil than to produce it from domestic coal or lignite.

To better understand the situation here, it may be well to review briefly Germany's experience with distillate fuels. Right after the war, when Field Intelligence teams investigated production facilities, it was found that the German chemical industry had succeeded in providing more than 4.5 million tons, or 100,000 barrels a day, of synthetic liquid fuels from coal for their war machines. As early as 1933 the German government began the construction of 10 synthetic liquid fuels plants of the coal hydrogenation or so-called Bergius type, and later in the war synthetic-fuel plants of the Fischer-Tropsch type were added. Both types functioned until they were bombed out. Prior to the war, similar plants were in operation in England, Japan, and possibly in other countries. Since the war many countries, including Canada, Scotland, Italy, Australia, Finland and Spain, have indicated either that research and development programs are underway or that pilot plants already have been constructed. A 100-ton per day commercial coal-gasification plant recently has been constructed in Finland for the Finnish government by Koppers of Germany. It is similar to the coal gasification plant built in this country by Koppers (US) at the Bureau of Mines' Louisiana, Mo., demonstration plant. A commercial-sized synthetic liquid fuels plant also is now being built in Africa by M. W. Kellogg for the Government of South Africa. It is scheduled to get into production within a year.

BUREAU OF MINES RESEARCH

The US Bureau of Mines has kept in touch with German progress in synthetic liquid fuels research ever since 1924, although it did not begin actual laboratory studies until 1936, or about the same time Carbide & Carbon Chemicals Company initiated its research on chemicals from coal by hydrogenation. By 1944 the Bureau was ready to step up its work to pilot plant scale. Thus the way was paved for the Synthetic Liquids Fuels Act of 1944, under which the Government established laboratories or pilot plants at Bruceton, Pa., Louisiana, Mo., Morgantown, W. Va., Rifle, Colo., and at Laramie, Wyo. Immediately after the war, when the Government was investigating possible new sources of liquid fuels, the Secretary of the Interior requested the Army to determine suitable areas in the US and Alaska for locating synthetic liquid fuel plants. Such a survey was made by the Corps of Engineers under a contract with the engineering firm of Ford, Bacon & Davis. The report of this firm, submitted in March, 1952, disclosed that more than 200 general areas in 25 states meet all requirements for one or more commercial-sized synthetic liquid-fuel plants and that these areas will support production at any rate up to 15 million barrels of finished products a day. Only two states, Colorado and Utah, meet the requirements for oil-shale operations. These states could produce up to seven million barrels of products a day.

OIL SHALE RETORTING

Various processes and types of equipment have been developed to recover oil from shale, one of the more promising methods being the so-called gas-combustion process. In this process, crushed shale is gravity fed at the top of the retort and passes down successively through preheating, retorting and cool-

This article by Mr. Branin is reprinted from the April, 1954 issue of MECHANIZATION, THE MAGAZINE OF MODERN COAL.

ing zones, Recycle gases, previously stripped of oil content, are used to cool the spent shale. As these gases enter at the bottom and pass upward, a small amount of air is admitted to burn the gases and thus raise the temperature enough to retort the shale. When the oil-laden gases enter the shale preheating zone they are cooled and form an oil fog, which leaves the retort at about 150 F. and is recovered from the gas stream by simple mechanical separators. In addition to being a continuous operation, the gas combustion process has the advantage of requiring no external heating or cooling equipment, no process water consumption (an important advantage in the West), and low power requirements. The Bureau has recently completed the construction of a larger, 200-barrel-per-day combustion retort and preliminary operations on this plant are just getting underway.

HYDROGENATION PROCESS

In this process, coal, lignite, or coal tar may be used as the raw material. It is first pulverized and then made into a slurry by being suspended in a heavy oil, after which it is subjected to the action of hydrogen at high temperature and pressure in the presence of a catalyst. The coal or other raw material is thus converted to a liquid resembling heavy fuel oil. From the first processing stage, light and heavy oil fractions are separated, the latter containing ash, unreacted coal, catalyst, and non-reactive asphalts. After removal of these substances, the heavy oil is used for pasting oil. The light oil fraction is subjected to further hydrogenation in a vapor phase operation, the product from this stage being mostly gasoline. Recently a one-step hydrogenation process has been developed by the Bureau of Mines, but thus far it has been tried only on a laboratory scale.

GAS SYNTHESIS PROCESS

The gas synthesis or modified Fischer-Tropsch process utilizes coal, coke, lignite, or natural gas as the raw material. The basic material is first reacted with steam and oxygen to form synthesis gas, which is a mixture of carbon monoxide and hydrogen. After purification, the synthesis gas is passed through a catalyst bed in the reactor to form synthetic gasoline and other chemical substances, the yields varying with conditions of temperature and pressure and type of catalyst employed. The conversion rate is about 70 percent per pass, so a commercial operation presumably would have two convertors connected in series. Under these simulated conditions at Bruceton the yield was 90 percent or better. Reaction products, consisting of a mixture of liquid hydro-carbons and oxygenated compounds, would go to a refinery for separation of the various fractions, after which they would be processed by conventional refinery methods. Synthetic gasoline in runs at Bruceton accounted for 52.4 percent of the liquid hydro-carbons and the balance comprised 10.0 percent diesel oil (400-600 F.), 16.0 percent heavy distillate (600-842 F.), 11.1 percent wax (under 842 F.), and 10.5 percent oxygenated compounds. The heavy distillate and wax fractions can readily be cracked to the diesel or gasoline ranges.

COMMERCIAL POSSIBILITIES

It appears now that the oil-from-shale process is closest to commercial realization and may in fact get underway within a few years. Both the National Petroleum Council and the Bureau of Mines have indicated a belief that gasoline could be produced by this process and delivered on the West Coast at a price only a few cents a gallon higher than gasoline from natural petroleum. Facilities for removing oil from shale presumably would be placed near the shale mines, which would facilitate disposal of waste shale as well as reduce transportation costs. The crude oil, after visbreaking, could be piped to the West Coast for refining, or it could be refined in Colorado or Utah and the products piped to the coast.

Both of the liquid fuels from coal processes have certain desirable features and these as well as cost factors are influencing research and development work on them. Present indications are that hydrogenation will find its greatest usefulness in the manufacture of coal chemicals, while the gas synthesis process will

(Continued on Page 14)

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Not only do work-saving electrical appliances do the cooking, cleaning, washing and drying for the busy housewife in her home, but electricity also makes jobs easier for everyone who works in factory, office, or on the farm. Electricity lights our way, entertains us, cools us, warms us . . . does all these things for just pennies a day.

Our hats are off, Mr. Edison. We're all happy to join the electric industry in Celebrating Light's Diamond Jubilee.

ASCE Announces Names of Officers

Following a mail ballot by its more than 37,000 members, the American Society of Civil Engineers, has announced at its headquarters in New York the election of William Roy Glidden, of Richmond, Virginia, as president. Glidden is assistant chief engineer of the Virginia State Department of Highways.

The new president, who will serve one year, succeeds Daniel V. Terrell, of Lexington, dean of engineering at the University of Kentucky. Glidden will take office October 20 at the Society's annual meeting in New York.

The Society, oldest national organization of engineers in the country, also announced the election as vice-presidents of Frank L. Weaver, Washington, D. C., chief, Division of River Basins, Bureau of Power, Federal Power Commission, and Louis R. Howson, past-president of WSE, of Chicago, partner in Alvord, Burdick & Howson.

New Directors are Don M. Corbett, Washington, D. C., district engineer, U. S. Geological Survey; Lawrence A. Elsener, San Francisco; Jewell M. Garrelts, professor at Columbia University; Frederick H. Paulson, Providence, R. I.; George S. Richardson, Pittsburg, and Graham P. Willoughby, Birmingham, Ala.

Glidden, native of Boston, was graduated from Massachusetts Institute of Technology in 1912. For several years he was on the staff of the Massachusetts Highway Commission. On recommendation of the U. S. Bureau of Public Works, Glidden was invited by the State of Virginia in 1916 to take charge of the bridge division of its Highway Department. He has been engaged since then in Virginia's many millions of dollars of highway and bridge construction. Glidden has served on numerous national, state and regional committees in that field and has written and lectured extensively on the subject. He has been a member of the engineering faculty of the Virginia Mechanics Institute and has given special courses at the University of Virginia and Virginia Polytechnic Institute.

Glidden joined the American Society of Civil Engineers in 1922. He has been a vice-president and a director of the Society and has been president of its Virginia Section.

Suggests Middle Path In A-Bomb Proofing

A middle path between the popular defense theories of A-bomb-proofing and dispersing industrial buildings was suggested in Michigan City, Ind. by a Chicago scientist.

Ray W. Sauer, supervisor of structural analysis at Armour Research Foundation of Illinois Institute of Technology, advocated:

—Dispersal to a degree that will lessen vulnerability of essential industry, when this can be done without disrupting the economy.

—Shelters that will offer protection, but which fall short of being bomb-proof in close proximity to a nuclear explosion.

Sauer addressed his remarks to the Northern Indiana section of the American Society of Civil engineers at its annual dinner meeting in the Spaulding hotel.

"Buildings can be made resistant to atomic bombs, but it is not economically feasible, nor is it wise, to build many of them that way."

Such a program would result in a waste of manpower and resources, which would harm this country and aid the enemy, he said.

Spacing of critical structures at such distances that no two of them could be destroyed by a single bomb, Sauer called "the worst possible means of defense."

In order to do this, the industrial centers would have to be dissolved, he explained.

"It would be folly to sacrifice productivity in the name of protecting it. It is not within our power to transform a city from a target to no target."

It is possible, though, to reduce the target attractiveness of cities, he said, by less extreme measures.

A partially bomb-proof structure could be built cheaper by using less material if some degree of flexibility could be incorporated in the design, he explained. It might be distorted, but it would still stand after an explosion.

Sauer said the nation's engineers should take the initiative in offering a plan for "survival of the nation."

The plan he advocated would provide for the enactment of regulations equivalent to nation-wide zoning regulations and building codes. These would be enforced by the government for certain strategic industries.

All industry could not be protected because, in many cases, it would be cheaper to rebuild a factory two or three times for the cost of bomb-proofing it, he felt.

Because of the selective nature of the plan, he said, only the national government could direct it to prevent widespread waste.

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Construction

(Continued from Page 5)

next few years. As an industry, construction is one of our largest and most essential.

Construction and the National Economy

Finally, therefore, let us look at construction as a factor in the national economy.

It is an axiom of American business that a large construction volume and mounting prosperity go hand in hand. Which of the two is the cause and which the effect is a subject of perennial debate. There are good arguments on both sides.

In the short term, it is certain that the demands and the psychology of a swelling boom tend to bring out new construction projects. To that degree, the construction volume is the result of the boom. But in the long term, it is equally certain that the consistent development of new products, coupled with rising efficiency and productivity in industry, creates the additional purchasing power that makes for higher standards of living and business activity. And, as we know, construction plays an essential role in ths modernization of our productive processes.

An Expanding Economy

Most Americans understand pretty well that the consistent maintenance and elevation of high living standards must result from an expanding economy. But it is not so clear just what that term means and just what creates an expanding economy.

Many conditions may account for the continuing infusion of new wealth that makes for an expanding economy. In the 16th century, Europe enjoyed an expanding economy based on the discovery of new lands and new wealth in the Western Hemisphere and elsewhere in the formerly unknown world.

In the 19th century, the United States had an expanding economy based on the opening of the West, with its new lands and new wealth together with the stimulation of wealth production by the invention of mechanical power.

In the 20th century, we are still—or, if you prefer, again—in an expanding economy. But this one is not based on the discovery of new natural wealth. To be sure, there still are some geographical areas to be exploited and there still is room for more intensive cultivation of the known areas. But, our present expanding economy is based for the most part on technology; i.e., the findings of the scientists as translated by our engineers and our industries into new forms of wealth and greater capacity to produce.

As we have noted in our quick review of construction in the development of America, it is in large measure through construction that we are able to put our scientific progress to work. It is the builder who provides so many of the works and facilities that enable us to increase our output and to derive more production from every hour's work.

New construction accounts for almost half of all private investment. Gross private domestic investment, not counting inventories, is estimated at $48.2 billion for 1951. Of this amount, 48.3 per cent was spent for new construction and the rest for machinery and other producers' durable equipment.

This is a never-ending process so long as our technology continues to spark and fuel an expanding economy. For the purpose and the effect of technical progress is to obsolete the standards and methods of yesterday. New discoveries make possible new products and services. They make possible more efficient and more productive machines and other facilities. This constant replacement of the outmoded by what is newer and better is the outward and visible sign of the expanding economy. And construction is one of its major prophets.

A few years ago, a European visitor and I were crossing one of the highest passes of the Continental Divide in the Rockies. The highway we travelled was under improvement. It was being widened and surfaced, and its grades were being eased to facilitate the increasing traffic. The visitor commented, "Only a very rich country could be doing this." To which I replied, "Perhaps, but only a country that does this can be rich."

Thus, the construction activity of the nation is at most a cause and at least a measure of the nation's standard of living.

It is impossible to measure the effect of construction on the over-all productivity of the American economy. But it is clear that continued expansion of industry depends upon the maintenance and expansion of power, transportation and other facilities provided by the construction industry. And the health and happiness—the incentives—of the work force are closely bound up with the existence of an adequate and expanding supply of good homes, schools, hospitals, highways and community facilities.

But the short-term impact of construction when it is stepped up as the result of a boom tends to create an instability in the economic cycle that is the most vulnerable feature of our economy. We know that expenditures for new construction are subject to much greater swings than those experienced by most other segments of the economy. Note that between 1929 and 1933, the physical volume of new construction dropped 68 per cent while gross national product (in constant dollars) fell only 28 per cent. During the recovery period

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1933-1937, gross national product rose by 43 per cent while new construction shot up by 104 per cent. During the prosperous 1920's, new construction was about 11 per cent of the gross national product; during the 1930's, it dropped to 6 per cent. In passing, it is worthwhile to note that recently the new construction share of our business activity has been in the bracket of 8 per cent to 9 per cent.

Moreover, as construction constitutes more than 12 per cent of the gross national product, and its workers are more than 5 per cent of those gainfully employed, such swings exert a heavy influence on the national economy as a whole.

The effect is even more widespread than these figures indicate. For every five workers directly employed in construction, we have another six workers in the industries that supply materials and equipment who are severely affected by its fluctuations. Thus, about 10 per cent to 11 per cent of the labor force are dependent in some degree on construction for their jobs.

These extreme swings are not inevitable. The construction industry and the federal government now have the means, between them, to cut the ups and downs substantially.

Government can help primarily in two ways:

1. It can concentrate its own major construction programs as much as possible in periods when other construction activity is lowest.
2. The government can use its system of mortgage guarantees and its control of the interest rate and the supply of credit to help stabilize homebuilding.

Industry can do its part in promoting stability by keeping construction costs down and by continually searching for new ways to make a better product.

One way to smooth out home building is to broaden the market for homes by developing a replacement market; and lower costs are likely to be the way to that market. Much of our present housing is inadequate, but it often is not replaced simply because the homebuilding industry cannot provide better housing at a cost people are willing to pay. Prices and rents for existent dwellings will probably be lower in the future as more vacancies appear, and builders will have to cut the cost of new homes if they want to compete with these older dwellings.

The housing industry and the people who make its materials have developed many new techniques to bring costs down; prefabrication of sections, or even entire houses; cheaper, more standard building materials; increased use of machinery. More needs to be done along these lines, and more progress must be made in eliminating restrictive union practices and obsolete building codes that now curb the use of superior methods.

Determined application of cost reducing techniques could also develop a larger replacement market for industrial commercial buildings. Manufacturers can often improve their productive efficiency by moving into a well-designed new building—*Factory* magazine reports that a Cleveland die and machinery company is able to save about 5 per cent on total manufacturing costs as the result of moving into a new plant. Retail stores also can improve sales and save on overhead in a modern structure. But companies will not be interested in moving into new buildings unless their cost is reasonable in relation to the savings they make possible—hence the need for lowering costs.

What of the Future

The facts, however, outweigh the problems. Our higher standards of living depend on an expanding economy. Construction has been a dynamic force in assuring such an expansion. How can it continue to play an equally vital role in the future?

For most of the past century, its nourishment was drawn from an urge to exploit the ever-widening geographic frontiers. It was new cities that required new water supplies and sewage plants. The railroad and the highway reached out into virgin territory. The new land needed the quickening waters of the reclamation projects, the growing settlements needed protection from floods, and sought new resources of power.

But today, the original installation of our country is well in hand. The day of providing new facilities in open, uninhabited territory is about over. Where does construction go from here?

To a considerable degree, it must work back over the same area to rebuild to ever higher standards. But even more important, it must provide the new facilities demanded by a people who are seeking higher living standards, who are intent on achieving a higher degree of national security in a disturbed world, and who command the ever-increasing productivity that is necessary to realize those objectives.

In the domain of home building alone, it is safe to say that no more than a few hundred thousand persons have the home of their dreams. A hundred million others will not be satisfied until they are

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housed in a manner more in keeping with all of the power-using gadgets designed to make living easy and efficient. To supplement these, new power-generating facilities must be built and factories must be constructed in which to manufacture the products than an advancing science constantly promises to the people.

The modernization of existing facilities and the construction of new ones point to as big a job in the partially built U.S. of 1952 as that which was done to provide the bare necessities during the pioneer period of the past century. At that time, the extending geographic frontiers offered an opportunity for the construction industry to grow as it built the physical plant of a new nation. But now, the new frontiers of technology are no less challenging, and the opportunity is at hand to rebuild that plant to meet the aspirations of a people who never have been willing to accept for tomorrow the living standards of today.

The basis of this hope for the future of our country, as well as of construction, is implicit in the character of the American economic system with its distinctive reliance upon freedom for the individual. As we have seen, construction genius has played an important part in building our country to its present high level of productivity. Other factors also have helped: natural resources, human labor, funds for investment, and powerful incentives. But none of these was new in the history of the world. They all had played parts in the development of other nations in other eras. In the case of the United States, the new factor was individual and personal opportunity; equal opportunity for every individual to shape his own destiny, and to rise as high as he could through his own intelligence, skill, and willingness to work. On such equality of opportunity our American enterprise system has been founded.

And just as the amazing physical expansion of our country during the last century derived in large measure from this atmosphere of individual freedom, we may be certain that a continued expansion, now arising from our scientific and technological progress, will find its chief motive power in that same freedom of mind and spirit. Let us guard well this well-spring of our national genius.

Build Wind Tunnel for Heat Transfer Study

A wind tunnel especially designed for heat transfer studies just below the speed of sound will be constructed at Illinois Institute of Technology, Chicago, under an Air Force research contract.

Purpose of the studies will be to gather basic information which can be used in such problems as de-icing and anti-icing at the high subsonic speed levels. The tunnel will maintain a jet of 575 horsepower.

Little heat transfer research has been done at this velocity range so far, said Dr. Max Jakob, director of the heat transfer laboratory of Illinois Tech's mechanical engineering department and one of the foremost authorities on heat transfer.

Announcement of the tunnel's construction was made after the Air Force granted a $40,000 extension to a 1952 contract for heat transfer research work at IIT.

Unlike the better known wind tunnels, this one will be small and relatively inexpensive but will incorporate many of the features of the larger tunnels, Dr. Jakob said. It should be completed by the end of the year.

Prof. Stothe P. Kezios, designer of the tunnel, described it as forming a rectangle and occupying an area 25 by 50 feet. Widest part of the tunnel, he said, would be a 5-foot square cross section.

But the portion where the actual test speeds are attained will be a "throat" 3 inches wide, 20 inches high, and 36 inches long. In this restricted area, precision studies will be conducted on the leading edge of an airfoil 6 inches long, Kezios said.

The tunnel will be capable of maintaining a high velocity airstream with a relatively low horsepower compressor because the air will circulate continuously rather than being exhausted after passing the test area, he explained.

Additional efficiency is made possible by structural design which conserves most of the energy of the air as it passes out of the throat into a wider section of the tunnel, he said.

Methods Engineers to Attend Study Clinic

More than 2,000 production executives and methods engineers are expected to attend the 18th Annual Time and Motion Study and Management Clinic sponsored by the Industrial Management Society scheduled for Nov. 10-11-12, 1954 at the Hotel Sherman, Chicago.

Thirty leading authorities from management, labor and industry will discuss the latest developments in the fields of time study, motion economy, job evaluation, methods, plant layout, incentives, and human relations. In addition to the technical sessions, an industrial exhibit will be held featuring new products, processes, and services applicable to the industrial engineering field.

Feature of the event will be the Annual Methods Improvement Competition, with awards to companies and colleges for outstanding advances in industrial engineering techniques and applications.

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Liquid Coal

(Continued from Page 8)

have the edge on production of synthetic liquid fuels. The latter process is also well adapted to the production of certain types of coal chemicals. The National Petroleum Council in its final report* on cost of producing synthetic liquid fuels from coal, issued in February of this year, concluded that distillate fuels could be produced by gas synthesis or Fischer-Tropsch process at a somewhat lower cost than by hydrogenation. The report also recommended that Government experiments on gasoline by hydrogenation be discontinued because of the greater promise of other methods, that is, from oil shale or the gas-synthesis process. However, private capital is going into both processes and both are receiving attention in industrial research laboratories. It would be sheer folly at this time to predict that one would eventually serve the synthetic liquid-fuels industry to the exclusion of the other.

Major improvements have been made in the Fischer-Tropsch process since the war, particularly in size and type of reactors employed. The massive batteries of cells used in Germany for this purpose have given way to more conventional-type reactors with modest space requirements. A present day unit resembles a petroleum refinery in general appearance. Another major advance has been in the transition from a fixed to a moving-catalyst bed. These improvements have resulted in lower capital costs. In fact, without the newer-type reactors it is doubtful whether the process ever would have much usefulness in this country.

* Final Report of the National Petroleum Council's Committee on Synthetic Liquid Fuel Production Costs, February 26, 1953.

SYNTHESIS GAS PRODUCTION

The production of synthesis gas may be considered common to both the gas synthesis and hydrogenation processes, since it serves as feed stock for the former and may be used as the source of hydrogen for the latter. Much of the Bureau of Mines' research on synthesis-gas production is centered around the Morgantown Laboratory where developmental work on gasifiers is taking place. At present, two types are being tried out, one a low pressure unit developed in conjunction with Babcock & Wilcox Company. It is similar to the unit now being constructed by that company for E. I. Du Pont de Nemours, Inc., at its Belle, W. Va., Works. The other is a high-pressure gasifier operating at about 450 pounds per square inch. The low-pressure gasifier, operating at atmospheric pressure, has a through-put of 20 pounds per cubic foot per hour while the through-put of the high pressure unit ranges up to 800 pounds per cubic foot per hour. Among the advantages of these gasifiers are their adaptability to a wide range of coals, including cheaper grades, and freedom from restrictions on sizing, cooking ability, volatile matter or low ash-fusing temperature. Operating advantages include a steady flow of process materials through the gasifier and ease of continuous slag removal by methods similar to those employed by electric utility companies for pulverized coal-fired boilers.

LIQUID FUELS vs. COAL CHEMICALS

Following the war, the primary interest was in rapid development of a synthetic liquid-fuels industry, and both Government and industry efforts were bent in this direction. However, with changing world conditions of the past five years, including apparent availability of an adequate supply of foreign oil, the emphasis has unmistakably shifted to manufacture of coal chemicals

(Continued on Page 19)

Approximate centers of preferred suitable general areas, synthetic liquid fuel potential of United States.

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Any member of the Society may compete regardless of grade of membership.

Papers shall not be highly technical in nature. A clear, concise and interesting coverage is desired rather than complex formulae or derivations. The subject discussed should be of general interest to engineers but should not be of a political or highly controversial nature.

All members of the Society who wish to submit papers in this contest should contact the Secretary as early as possible and not later than February 1, 1955, and request a copy of the rules governing the competition and an outline of the minimum requirements for acceptance of papers. These cover in detail the mechanical make-up which should be followed in preparing and submitting papers for the contest.

Papers must be submitted to the Secretary for acceptance by April 1, 1955. If the Secretary finds that they meet the minimum requirements of the contest, he will forward them to the Awards Committee for review. The papers will be identified by number only. The Secretary of the Society is the only person who will maintain the key to the authors.

If any paper does not comply with such minimum requirements, the Secretary will so advise the author and discuss with him the points which are below the minimum requirements. The papers which are accepted will be forwarded to the Awards Committee for judging not later than May 1, 1955. Papers which have not met the minimum requirements by that time cannot be considered for prizes.

Papers which are accepted will be judged on originality of presentation, editorial merit and value to the engineering profession.

The papers submitted must not have been previously published in substantially the same form. No copyrighted materials shall be used unless permission has been obtained and so indicated. All manuscripts, drawings, etc., are to become the property of the Society and cannot be published without the consent of the Society.

If the papers submitted are NOT of sufficient merit to warrant the award of any or all of the prizes, the Awards Committee reserves the right to award less than the five established prizes or to postpone the competition.

The winners will be announced and the prizes presented at the annual meeting of the Society in June, 1955.

WSE Executive Secretary will furnish you with a complete set of rules and minimum requirements on request.

On Training —
Letters from Leaders

In the last issue of Midwest Engineer we published another of about thirty letters received from leaders of Chicago-area firms concerning shortcomings noted in the engineers in their employ. Many of the letters also suggested what the engineers should do to correct their deficiencies.

Significantly, the engineer's technical training is generally considered adequate. In the broad area of Human Relations, however, engineers seem often to be "under achievers," according to the viewpoint of the industrial leaders as reflected in their letters.

Here, then, is the next letter:

Dear Mr. Becker:

This is in reply to your letter of August 31, 1951 asking for an expression of our views as to deficiencies of engineers in respect to qualities which they must have to be able to advance to supervisory and executive positions.

Perhaps the one thing which could be singled out as being the deficiency most often met is the absence of, a "broad viewpoint" in connection with one's work. That is, to use a cliché, we feel that "to be big you must think big." Many engineers, although adequately trained from a technical standpoint, are woefully lacking in background as to where their particular specialty fits into the overall scheme of our economic society. Not having this background, they are hampered in advancing to positions of leadership, which positions entail contacts with people in other fields, who are customers, associates, etc.

It appears to us that the present trend of specialization in engineering education has led to the omission of education in social sciences and the humanities, with harmful results. We notice this especially when we send our men out on their own on field work or client contact. Often, younger men don't seem to understand the responsibilities and the position an engineer has in relation to his client, or to contractors doing work under the engineer's direction. In other words they have learned to design engineering works, but have little or no grasp of the way such projects are carried out, from initial conception to final completion.

Certainly, not all engineers who are well grounded in economics, etc., as well as engineering are automatically good supervisors or executives, but such education does make it easier for those men who have the other needed attributes of aggressiveness, ability to lead and organize, personality, etc.

In summary, then, we feel that the complete education of an engineer if he is to be able easily to rise to a position of responsibility, should encompass studies in the fields of economics, social sciences and the humanities. We enclose a photostat of a pertinent part of the Baccalaureate address given to the senior class in June 1951 by Harold W. Dodds, president of Princeton University:

THE LIMITATIONS OF SPECIALIZATION

"The first thing to remember is that no speciality, of all the various ones you have studied, alone gives you the full material from which a philosophy of life can be constructed. This is the chief reason the faculty encourages, even compels, each of you to dip into branches of learning other than your field of concentration.

"By its very definition a liberal education includes three comprehensive areas of human relationships. These are one's relationship to the physical world revealed by science; his relationship to others revealed by the social studies; and finally—and all important—his relationship to himself through the spiritual and humane values of the humanities. No adequate philosophy of life is possible without reference to each of these three fields of learning.

"This is the reason command of a speciality, of one single segment of life, is not enough. It is true that one of the distinctive social phenomena of the day is vocational specialization, and there is no need to pause to discuss the obvious benefits which expanded knowledge, gained through specialization, has given us. The advances in medical care over the last thirty-five years are eloquent testimony to them (although physicians are beginning to worry about the need to put the specialities together in order that the fragments may be articulated in the cure of indivisible people). Specialization endangers the power of the mind to generalize; it destroys man's mental versatility by which he advanced beyond the pre-historic animals, which could not adapt themselves to changes in their environment and therefore perished.

"Today, respect for specialization goes so far as sometimes erroneously to equate the specialist per se with an educated person. Will Rogers fell into this trap when he said "There is nothing as stupid as an educated man if you get off the thing he was educated in." This view of what it takes to be an educated man reflects the modern stress that America is placing on specialization, which pays off economically for the individual at the heavy loss however to the Nation of truly educated democratic leadership. For as we all know, a nation composed only of specialists is getting ready for dictatorship.

"Indeed, one may easily turn his specialized preoccupation with one fragment of knowledge into a storm cellar where he can escape the pressures of a complicated universe which he does not want to face up to. Absorption in a single segment of learning may have the same false lure to peace of mind as the farms in Vermont or the ranches in Wyoming that we sometimes see advertised as refuges from the A-bomb. For you who will have the nation's work to do and the nation's responsibilities to carry, there is no true asylum to be found in flight to a speciality, as a shelter from the stresses and strains of a tough world.

"The really hard going intellectually comes when one tries to put together the fragments discovered by specialization into a pattern for framing policy. In the years to follow you will realize this more and more, as you become leaders in your businesses and professions, and have to build and execute policies affecting the lives of others. You may think that all that is necessary for a wise decision on policy is to get the facts; that when you have the facts they will speak for themselves. Nothing could be more misleading. Analysis is easy, getting the facts is easy, compared with the truly creative step of weaving the segments of experience and knowledge into a constructive policy for action or a guide to living. Facts, indispensable to a good senior thesis, alone do not rate first group in the final grade. The use you make of the facts, the meaning you derive from them, is the all-important final step. It is vain to look for a satisfying philosophy of life within the confines of a speciality."

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CRERAR LIBRARY

News and Notes

Crerar Library Associates and members of the Library's Board of Directors held a luncheon meeting in the WSE dining room on September 30. H. P. Sedwick, president of the Library, described the physical and financial status of the Library and its general field of operations. Herman H. Henkle, Librarian, described the collections and service organization of Crerar, and Dr. John T. Rettaliata, first vice-president, discussed industrial research potential in the Chicago region with special reference to the interest which business and industry have in the availability of the Library.

A large group of distinguished leaders in business, industry and the professions have accepted invitations from the Library's Board of Directors to become Crerar Library Associates. The principal purposes to be served by the group are two: first to establish a better understanding in the community of the existence and extent of this great technical reference library and the service it renders; and second, to secure the advice and guidance of outstanding executives, both technical and non-technical, in the scope and operation of the Library.

* * *

The week of November 1 brings to Chicago members of the American Society for Metals for their annual meeting. As in past years, the program includes sessions sponsored by the Metals Section of the Special Libraries Association, which has cooperated actively with ASM on matters relating to the literature of the field and its organization for use. On Wednesday, November 3, the Section's meetings are devoted to "A Day at Crerar Library," designed to acquaint librarians and research workers with the resources and activities of the institution and its staff. A general introduction to the Library and its technical society neighbors will be given the group, assembled in the WSE auditorium, followed by guided tours of the premises and lunch in the WSE dining room. The afternoon session in the auditorium will hear a panel of the Library's administrative officers discuss problems of literature organization, specialized reference, research and photoduplication services, and activities of the SLA Translation Pool. The programs will be supplemented by exhibits and distribution of descriptive literature.

Chicago Is Center for Industrial Designers

Chicago's increasing importance as a headquarters for industrial designers who shape the nation's manufactured products is being revealed to the public for the first time in a three-week exhibit opening Oct. 4 at Illinois Insititute of Technology.

The exhibit features a wide variety of products designed in the Chicago area in the last two years. Most of the area's industrial designers are represented in the show by one or more items of their own selection.

"Purpose of the exhibit," announces its general chairman, Ted H. Koeber, chief designer of the International Harvester company, "is to stimulate more people to appreciate and want good design."

"Because business and industrial organizations are beginning to realize that their sales can be fortified and increased by well-designed products, many of their representatives have expressed a wish to see the comprehensive type of display we are contemplating," he added.

Illinois Tech is sponsoring the exhibit in connection with its program to expand the facilities of its Institute of Design which is providing education for future industrial designers.

Assisting Koeber in making plans for the event is an executive committee composed of Dave Chapman of Dave Chapman & associates, G. Harold Hart of Reinecke & associates, current president of the Chicago chapter of the Society of Industrial Designers, and James Hvale, head of the industrial design department of Ekco Products company and president of the local chapter of the Industrial Designers Institute.

The exhibit is set up in the front and rear foyers and first floor hallways of Illinois Tech's Metallurgical and Chemical Engineering building at the northwest corner of State and 33rd streets. It is open to the public, admission free, from 9 a.m. to 9 p.m. each week-day and on Saturday until noon.

Only Chicago area designers were invited to exhibit that the showing may indicate the variety and scope of the work being performed by the local firms specializing in product design, the design staffs of the area's manufacturers, and some of the free-lance specialists in the field. There will be no judging of exhibits.

"For the first time in the city's history, attention will be focused on Chicago talent which is creating much of the best work being done in the field of industrial design," Koeber said.

He pointed out that the art and science of combining beauty, utility, and economy in mass-produced products has gained new significance today because of rapid technological advances.

"Industrial designers are being called on to create products that work better, look better, and sell better in order to maintain free competition in the American economy," he declared.

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Liquid Coal

(Continued from Page 14)

—with synthetic liquid fuels as a possible long-range objective. Many chemical substances resulting from both gas synthesis and hydrogenation processes are in strong demand and bring good prices. Hence, chemical "know how" of the synthetic liquid-fuels industry presumably can be developed on a pay-as-you-go basis. In the background is the realization that should future conditions warrant production of distillate fuels on a commercial scale, a backlog of experience with these processes will place any company in a favorable competitive position. Doubtless, Carbide &' Carbon's recent plunge into hydrogenation on a commercial scale has stimulated this trend.

PRIVATE RESEARCH TRENDS

Koppers Company believes that gasoline from coal on a commercial scale is not far off, and has recently given substance to that belief by forming a coordinated fuels processing section in the company research department. This new section is divided into hydrogenation, carbonization, gasification and by-product treatment branches. Both gas synthesis and hydrogenation processes are being developed by Koppers in pilot plants at the Verona (Pa.) Research Center. Present interest is centered especially around determining what chemical substances are recoverable from both processes in commercial quantities under various operating conditions—and in finding more effective catalysts and ways of improving yields. Although now American-owned and controlled, the company has a working agreement with Koppers Germany whereby technical information is mutually exchanged.

While producing only industrial and experimental chemicals by hydrogenation of coal at the present time, Carbide & Carbon has an extensive knowledge of the hydrogenation process resulting from 18 years of experience with the process. It also has an $11,000,000 semi-commercial plant with a capacity of 300 tons of coal per day, now undergoing enlargement, in which to develop ideas. As markets are found for these coal-hydrogenation chemicals, Carbide and Carbon will continue to expand this plant or construct new plant facilities, possibly spending as much as $500 million for this purpose. The company already is the leader in the synthetic aliphatic chemicals field, and the new facilities would enable it to occupy a similar position in the synthetic aromatic chemicals field.

Widespread belief exists that Carbide & Carbon has made some major improvements in the hydrogenation technique, having eliminated the vapor-phase step, lowered operating pressures to half those employed by the Bureau of Mines, effected a major reduction in contact time, and substantially reduced the quantity of catalyst required. These improvements should materially reduce production costs. However, comparison of the Carbide & Carbon and Bureau of Mines techniques should not be carried too far, since announced objectives are different. The commercial company is producing primarily high molecular-weight chemical substances, and the Bureau's major efforts have been directed toward low molecular-weight hydrocarbons of the gasoline and diesel-oil type. Under these circumstances, some differences in chemical processing are to be expected.

Following World War II, the Pittsburgh-Consolidation Coal Company entered into a cooperative arrangement with Standard Oil Development Company under which a pilot plant was constructed for production of synthesis gas, using the fluidized-solid technique and looking toward the production of synthetic liquid fuels. It was indicated that this step might be followed by full-scale commercial development. However, with changing world conditions this plan was discarded and the arrangement was finally terminated. More recently, activities of the coal company have taken a somewhat different course, the major emphasis now being on methods of producing marketable coal chemicals in commerical quantities.

Pitt-Consol's approach differs from that of other companies in that it involves as a first step the low-temperature carbonization of coal. The resulting low-temperature tar is then converted into chemical products by separating out the various fractions. At some future date at least part of the tar may be subjected to hydrogenation to obtain gasoline and other distillate fuels. This is not an entirely new approach to the synthetic liquid-fuels problem, for the Billingham plant in England has been hydrogenating tar and tar oils for some years, and the US Bureau of Mines has also investigated tar hydrogenation. The Pitt-Consol plan likewise has some elements in common with the Texas Power & Light Company project in which lignite is subjected to low temperature carbonization to secure char for boiler fuel, as a result of which large quantities of low temperature tar are formed. Developmental work on this project was done at Denver by the Bureau of Mines under company sponsorship.

Products from low temperature tar are similar, though not identical, to those formed by high temperature carbonization. Yields are different, and the gas is lower in illuminants and heat value. Tar yield is much greater, and the coke is in granulated char form. Presumably these substances could be utilized, or disposed of, by Pitt-Consol somewhat as follows: (a) the gas would be sold or used as a power source at

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the plant; (b) the tar would be refined to give various coal chemicals, marketed as a fuel, water-proofing or road-building material, or subjected to hydrogenation to give gasoline and Diesel fuel; (c) the char would be used as the basic feed stock for the gas synthesis process, for making hydrogen via synthesis gas, or marketed as a boiler fuel to produce power. It is interesting to note that feed stock material for both the gas synthesis and hydrogenation processes is formed in the low-temperature carbonization operation; in fact they are the substances formed in largest amount, namely, char and tar. Because of its flexibility, diversity of products formed, and opportunities for correlation and integration, such a plan appears to have interesting potentialities.

COAL CHEMICALS OR SYNTHETIC LIQUID FUELS

Both coal chemicals and synthetic liquid fuels can be made by both of these processes. Furthermore, both types and yields of products are subject to wide variation depending upon processing conditions and type catalyst employed. Hence, it is not possible to predict what a given manufacturer will do when the market for synthetic liquid fuels opens up. There is no doubt but that the immediate interest is in coal chemicals. However, there are also strong indications that most coal-chemicals manufacturers have a weather eye toward the synthetic liquid-fuels future. Some frankly admit they are exploring the possibilities, while others merely indicate they are interested. In any case, there is a considerable amount of construction of coal-chemicals plant facilities underway, some of which, however, represents replacement of obsolete equipment.

SYNTHETIC FUELS—WHEN

About 12 percent of the total oil supply of the U. S. last year was imported from foreign sources. As already pointed out, this imported oil is taking the place of high-cost native crude and/or synthetic liquid fuels from shale and coal. How much longer will it continue? Probably until world competition for foreign crude forces the price high enough for synthetic fuels from shale and coal to compete with it. Present indications are that this transition will begin to take place within the next ten years. A recent estimate** points to 1960 as the probable time for the beginning of oil-from-shale production, and gasoline from coal is expected to follow within another ten years or by 1970.

Honors Are Given to Einstein and Franck

The honorary degree of Doctor of Science in Technology was conferred on Professors Albert Einstein and James Franck at a special convocation of Technion, Israel Institute of Technology, held at Princeton Inn, Princeton, N. J., on October 3.

Two hundred educators and Jewish leaders attended the ceremony, at which J. W. Wunsch, president of the American Technion Society, presented the degrees. This was followed by a luncheon under the auspices of the Technion society.

Professors Einstein and Franck, who were unable to make the trip to Israel to receive the honorary doctorates, long have been supporters of Technion, which is the only engineering college in Israel. Now more than 40 years old, Technion is harshly overcrowded. A new Institute of Technology, known as Greater Technion, is being built on Mount Carmel, principally through the efforts of the American society. One structure already is finished. When the entire new campus has been completed it is expected Greater Technion will be able to turn out sufficient engineers, applied scientists, and trained technicians to meet Israel's need for more technological experts.

** Ayres, Eugene—The Long Range Outlook for Liquid Fuels in America.

88 Papers Are Given At Electronics Meet

Circuit theory, antennas, and electron tubes were subjects of papers presented Oct. 4, 5, and 6 at the National Electronics conference by staff members at Illinois Institute of Technology and its affiliate, Armour Research Foundation.

The 10th annual conference, held at the Sherman hotel, Chicago, offered a technical program of 88 papers covering a broad field of electronic research, development, and industrial application.

Dr. George I. Cohn, Illinois Tech professor of electrical engineering and secretary of the conference, and Bernard Saltzberg, of the American Machine and Foundry company, Chicago, delivered a paper on Oct. 5 on "Pulse Response of Nonlinear Circuits."

Dr. Cohn also participated in a paper on Oct. 6 on "Coaxial Omnidirectional Slot Antenna Arrays" with Stanley I. Cohn, assistant electrical engineer, and Alfred J. Hoehn, supervisor of communications, both of Armour Research Foundation.

A paper on the transit time of electrons in electron tubes was presented Oct. 5 by Mansour Javid, assistant professor of electrical engineering at Illinois Tech.

The technical program was supplemented by more than 160 electronics exhibits, according to James L. Murphy, assistant manager of the Foundation's electrical engineering department, who served as procedures chairman.

The National Electronics conference was formed in 1944 to provide a national forum for the presentation of authoritative technical papers on electronics.

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Starting with Wednesday night September 22nd, 1954, the Chicago office will again be open every Wednesday evening until 7:15 P.M. for your convenience. Come on in and make these nights work to your advantage in finding THAT position you would like to have or for getting THE engineer you need.

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C-2186 RESIDENT ENGR. CE. ME or EE. Age: 35-50 10 plus yrs. exp. in industrial and power plant construction. Know: power plant equipment and construction. Duties: Supervising construction engineer-architect. Sal: $6-7000 Loc: Wisc. Employer will neg. fee.

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Call Research Investment Essential

Failure of industry to risk an investment in research is an invitation to loss of business and eventual extinction.

This view was expressed in Philadelphia on Sept. 22 by Dr. Maurice J. Day, assistant director in charge of program development for Armour Research Foundation of Illinois Institute of Technology, Chicago.

A gamble of money against possible knowledge must be taken by industry if the nation's greatest natural resource—intellectual ability—is to be tapped, he emphasized.

He warned that scientific investigation requires patience. Months of stubborn effort may be needed before a problem yields to laboratory attack, and even then the results may be disappointing, he said.

"That is one of the risks of the business. In a well-organized laboratory, however, the risk becomes calculated."

The art of good laboratory management, Dr. Day added, is to organize and develop to its highest point the initiative of specialists, so that the results progress orderly toward a given goal.

Answering the question of how much communication is needed between scientists in a laboratory, the research administrator described the "Armour Plan," the key to organization at Armour Research Foundation.

Under this plan of coordinated teamwork, one section within a department is made responsible for a given project, although various aspects of work are subcontracted to other sections, thereby utilizing the economy of specialization.

Overlapping of one department's studies with those of another is not a handicap, Dr. Day pointed out.

"The dual approach is healthy because it provides a forceful reminder that one group should not let its own point of view become too narrow. It also is beneficial simply because one approach to a research problem may be more successful than another."

Most organizations are built up in military fashion with a "chain of command" system of reporting to superiors. In a research organization, however, it is important to move as far away from this military-type discipline as possible, he said.

"Unlike an Army, research cannot be planned from the top. It is only the individual research worker who is in a position to plan his next steps on the basis of information established from his own experiments.

"Lines of organization must be observed to avoid confusion when action is to be taken—but never merely to enforce discipline or promote empire building," he added.

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Mathematics	4,396	1,274	29	677	112	16	241	14	6
Biology	9,707	2,745	28	1,891	346	18	966	117	12
Chemistry	5,943	1,073	19	1,211	116	10	999	51	5
Geology	1,719	68	4	517	8	2	133	3	2
Physics	102	1	1	50	0	—	13	0	—
Engineering	24,189	37	0.15	3,566	13	0.03	518	1	0.02

Women in Science

Representatives of industry and education, reports Engineering and Science Manpower *Newsletter,* met at Bryn Mawr recently to consider the recruitment of women for careers in science. The summary of conclusions merits careful study, and, though basically sound, it suggests that some important factors in career selection may not have been given as much weight as they deserve. Some of these follow. Chief among them are the domestic and social environment in which most young women are raised and the lingering reluctance of industry to employ women for technological and scientific work.

The record of earned degrees in 1953 shows that mathematics and biology attract women students in greatest numbers, whereas engineering draws the fewest. (See tabulation above.)

In the total college population women comprise roughly one third, and the percentage drops but slightly through the master's degree level in the graduate schools. At the doctorate level, however, fewer than 10% of the degrees granted go to the women. Among the sciences only mathematics and biology approach the norm in the undergraduate field, but both follow the same curve of rapid decline in the graduate schools. As compared with the record in the social sciences and humanities, the figures reveal that a small proportion of women take advanced training for the master's degree, and that, except in biology, the number who take the Ph.D. is negligible.

At a time when the nation is faced with an acute shortage of science teachers in high schools and of trained scientists in industry, government, and education, the pool of womanpower is of especial strength. In its study of "Manpower Resources in Chemistry and Chemical Engineering" (Bull. 1132, 1953), the Bureau of Labor Statistics offered the following analysis of employment. (See tabulation below.)

It was found, also, that of all chemists in the labor force, only 7.7% are women, notwithstanding the fact that 15% of those currently receiving degrees in chemistry are women. A more critical analysis, however, would bring out several significant facts — e.g., that in the age group under thirty, 15% are women; that the percentage of men and women with bachelor's degrees who enter industry is almost the same; but that the loss of girl graduates to the profession is relatively high within the first year following graduation, and many do not even start professional work or advanced training.

This loss reflects only in part what has aptly been called the high maritality rate. More important is the absence of professional motivation. Many a science major is chosen solely because it is more "exciting" than literature, and in some coeducational institutions science majors have proved an attraction because of the preponderance of men in the courses that must be taken.

For the many women who are seriously interested in science careers there are severe handicaps. Women as a class are more eminently suited for certain types of scientific work than for others, and in some, experience shows that they excel men. Yet there is no attempt to give academic recognition to the mental and manual differences between men and women, and the latter not infrequently resent any implication that they exist. In job opportunities—and sometimes in the classroom—women find themselves at a competitive disadvantage with men, and most of those who stay in the profession know that they have to be well above the male average in mentality and skill to succeed. And for the most part the professional woman is still so rare as to be a social curiosity, and the choice of a career in science consigns her to social isolation.

These and other qualifying factors must be recognized before womanpower will add substantially to our scientific and technological strength. Efforts should be made to remove whatever industrial prejudices and social hurdles still bar the way to science careers for women and to plan more judicious university curricula. Meanwhile, emphasis may well be placed on the service they can perform as teachers of science. Of the 4,000 students who completed high school teaching certificate requirements in science in 1953, only 1,150 were women, although two-thirds of them actually accepted teaching posts as contrasted with 43% of the 2,825 men (see NEWSLETTER No. 59, June 3). It is not out of order to urge college and university departments to turn their attention to the instructional needs of prospective high school teachers of both sexes, and to introduce courses that will attract, as well as train, new teachers.

Type of Employment	Men	Women (%)
Manufacturing Industries	71.5	49.2
Education	13.1	27.7
Government	7.9	9.8
Other	7.5	13.3

Ceramic Coatings Prolong Life of Parts

The life of exhaust systems and parts subject to high temperatures can now be increased from three to five times through the application of high temperature ceramic coatings in such areas as automotive, trucking, marine and heating equipment, it was announced Sept. 10 by the Bettinger Corporation, Waltham, Massachusetts.

This new development has been made possible by coating the entire exhaust system, both inside and out, with a 0.001 to 0.002 inch thick high temperature ceramic coating, which resists corroding gases and withstands extreme operating temperatures up to a range of 2200° F.

"Based on the successful completion of laboratory work and a series of pilot projects," Robert A. Weaver, Jr., president of Bettinger stated, "we are convinced that this advance in the technology of high temperature ceramic coatings will be as successful as our continuing work with the 'hot parts' of jet engines, which began in late 1951."

Bettinger was the first company to solve the production line problems involved in coating "hot parts," including combustion liners and collector rings for the J-47 jet engine. This resulted in increasing the jet engine life span from three to five times. In addition, by coating low alloy steels with high temperature ceramic coatings, Bettinger enabled these metals to replace more costly and scarcer high-alloy steels.

Utilizing the knowledge gained from processing high temperature ceramic coatings on jet engine parts, Bettinger has been engaged in research during the past year designed to extend their production knowledge to other fields, where high operating temperature and corrosion are a limiting factor in the life of machine parts.

"After coating tens of thousands of jet engine parts," Weaver said, "we know that the knowledge and experience gained from that work will greatly facilitate this new work, since the problems involved in parts replacement as a result of heat intensity are similar."

WSE Applications

In accordance with the By-Laws of the Western Society of Engineers, the following names of applicants are being submitted to the Admissions committee for examination as to their qualifications for admission to membership into the Society in the various grades, i.e., Student, Associate, Member, Affiliate, etc. All applicants must meet the highest standards of character and professionalism in order to qualify for admissions, and each member of the Society should be alert to his responsibility to assist the Admissions committee in establishing that these standards are met. Any member of the Society, therefore, who has information relative to the qualifications or fitness of any of the applicants listed below, should inform the Secretary's office. The Secretary's office is located at 84 East Randolph Street. The telephone number is RAndolph 6-1736.

70-54 Joseph R. Werth, Jr., Development Engineer, Western Electric Co., Hawthorne Station.

71-54 Max L. Clark (Rein.), Trans. Engr.-Trunk Design, Illinois Bell Telephone Co., 208 W. Washington St.

72-54 Raymond F. Stone, Training Advisor-Constr'n., Commonwealth Edison Co., 72 W. Adams St.

73-54 Arthur F. Keith, Mgr. Production Engrg. Dept., Precision Scientific Co., 3737 W. Cortland St.

74-54 Edward J. Mullooly, Supervisor, Safety and Training, Commonwealth Edison Co., 2233 S. Throop St.

75-54 Walter A. Coxe, Assistant Dist. Foreman, Commonwealth Edison Co., 72 W. Adams St.

Casting Institute To Meet on Nov. 3-4

The Second Annual Meeting of the Investment Casting Institute will be held Nov. 3 and 4, 1954, at the Congress Hotel, Chicago. V. S. Lazzara of Casting Engineers, Inc., Chairman of the Institute's Program Committee has announced that the Nov. 3 session will be devoted entirely to Institute business, so that the second day, Thurs. Nov. 4, can be reserved for a study of the technical details of producing investment castings.

The Technical Sessions will include talks and discussions by nationally known authorities on such topics as "Proper Gating, Sprueing and Risering," "Metal and Mold Temperatures," "Melting Techniques," "Heat Treatment," and "Investments."

The speakers will include representatives of such organizations as Armour Research Foundation, Battelle Memorial Institute, and M.I.T.

Other subjects to be discussed at the Business Session will be the results of the Industry Survey Report in which every member of the Investment Casting Institute participated, and the election of officers and directors.

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Reviews of Technical Books

Engineering Analysis

Engineering Analysis, by D. W. Ver Planck and B. R. Teare, Jr., John Wiley & Sons, New York, N. Y., First Edition, 1954. 344 pages. Price $6.00.

Subtitled "An Introduction to Professional Method," the volume emphasizes what must be done to translate engineering situations into mathematical language and the necessary steps to be taken after a mathematical result has been obtained. An application of the case method to the teaching of the philosophy and methods of engineering analysis, the book may be considered a "how-to" within the scope of scientific thinking. It deals specifically with such matters as defining the problem to be solved, deciding what principle to apply, choosing coordinate systems, methods of checking, choosing dimensionless variables, and sketching the curves. In all these steps, the authors convey the entire engineering thought process by showing what the engineer would actually write down as his thoughts develop.

Practical in outlook, the book concentrates on problem solution, treating subjects from the point of view of their usefulness in engineering. Topics are included from dynamics of translation and rotation, electric circuits, heat transfer, solution of linear differential equations with constant coefficients, uses of power series, integration by graphical and numerical methods, hyperbolic functions, the evaluation of indeterminate forms, and dimensionless analysis. Broad patterns of thinking are developed and applied to specific problems throughout, chiefly in the fields of electrical and mechanical engineering. R.C.

Dynamics in Machines

Dynamics in Machines, by F. R. Erskine Crossley, The Ronald Press Company, New York, N. Y. First Edition, 1954. 463 pages. Price $7.00.

The author described his own work excellently as he set the purpose for this book on dynamics: "This book is intended as a text for the intermediate course in dynamics... a sequel to "introductory courses in statics, dynamics, and strength of materials." As such, it assumes that the student has a reasonable facility with the calculus and a good foundation in kinetics. The text, hence, after a review chapter which quite evenly takes the student through his previous courses in dynamics from the sliding plane to the more complicated angular momentum, launches forward into a more definitely-applied study of equations of motion.

The first chapter is an excellent gauge for the student to use in measuring his position with relation to the field. If he can recall the material of the first chapter, then the rest of the book, with some review of the more intricate manipulations of the calculus, if necessary, ought to teach him to apply the theories learned in the elementary studies of dynamics.

There are two outstanding features in the work which make it superior to many in the field. First, there is a definite smoothness, a building upon that which has already been studied, which gives the student credit for the knowledge he already has, and offers him an even-flowing pattern leading to a more advanced use of his knowledge of the field.

The second outstanding feature stems from the first: the text is an efficient bridge between the theoretical and the practical—it teaches the student to apply the basic theoretical formulae and set problems to existant practical situations. Obviously, in few books are all of the problems studied. In *Dynamics in Machines,* however, a well rounded selection of problems involved in harmonics, balance, speeds, vibrations, three-dimensional rotation, and the flexible motion of machine parts are studied.

A third important feature should be mentioned. The text's use of mathematics actually used in practice as well as on the drawing boards, gradually accustoms the student to mathematics considerably above that used on the theoretical level of elementary courses. Applied formulae become pictures rather than pieces of rote memory. In that sense the text might well be subtitled "Mathematics in Machines."

A.D.C.

Materials and Processes

Materials and Processes, by James F. Young, John Wiley & Sons, New York, N. Y., Second edition, 1954. 1074 pages. Price $8.50.

In this second edition of *Materials and Processes,* James F. Young retains the major objective that contributed to the volume's continued use for ten years. This new book again provides a broad study of the materials and manufacturing processes from the viewpoint of the engineer.

"Materials and Processes" has been almost completely rewritten for the benefit of those concerned with product development, design, production, processing, and quality. The emphasis throughout is on the engineering fundamentals of metallic and nonmetallic materials, manufacturing processes, and their applications to the above activities.

To provide wider usefulness, the author has expanded the coverage of nonmetallic materials, constructional materials, and many materials and processes used in product industries. Recent developments in physical metallurgy and chemistry have been added, as well as typical material property data and process tolerances.

Among the new chapters are those on metallographic examination, structure and properties of nonmetallic materials, rubber, statistical methods used in quality control, and ceramics, porcelain, and glass. New sections also appear on tarnishing, electric contacts, and nondestructive testing, while increased coverage has been accorded to such topics as bearing metals, superalloys, nonferrous elements, blow and shell molding, and pressure welding. R.C.

To Hold Power Exposition in Dec.

A series of special events is being planned in conjunction with the 21st National Exposition of Power and Mechanical Engineering at Philadelphia, Dec. 2 to 7. On the program will be papers and discussions of interest to visiting engineers including those attending the annual meeting in New York of the American Society of Mechanical Engineers, under whose auspices the exposition in Philadelphia's Commercial Museum will be held.

Of particular interest to A.S.M.E. members will be plans now being developed for an inspection trip from the Annual Meeting in New York to the Power Show via the Fairless Works of U. S. Steel Corp. on Friday, Dec. 3. On Monday, Dec. 6, there will be a joint meeting of the Philadelphia Chapters of the American Society of Mechanical Engineers and the American Society of Civil Engineers at Convention Hall.

Another timely event will be an all-day symposium on Automation to be held by the Instrument Society of America, Dec. 3, covering such topics as "Trends," "New Problems Created by Automation," "Automatic Intelligence Gathering Systems," and an analysis of "The Engineering Control Loop." Another event already announced is a dinner meeting of the Plant Engineers Club of Greater Philadelphia, to be held at the show Thursday, Dec. 2.

A fast-growing list of exhibits scheduled for first showing at the Exposition accumulated during the summer, as some 250 manufacturers completed arrangements for their displays. A sampling of specifications for "first time" exhibits includes an "Autolog" which records operating performances at as many as fifty trouble points in plant operation, an electric boiler of British origin, and a noteworthy new exhibit described as affording a more lucid presentation of the advantages of seamless manufacture of steel pipe and tubes.

Displayed with the Autolog will be a supersensitive gas detector which makes possible for the first time accurate sensing of toxic or combustible gases in concentrations as extremely low as five parts per billion. This instrument depends in principle on the detection of mercury vapor in ultra violet light—termed the most sensitive method of analysis known. The continuous model is suitable for indicating air pollution, for industrial toxic gas control, flue gas analysis, and other applications. A modified instrument may be used for quantitative measurement of ultra-violet absorbing materials, such as benzene, methanol, aromatic hydrocarbons and water vapor.

From an English source will come the first U. S. exhibit of a line of high grade electric motors, built to NEMA as well as British standards. Several new automatic variable-speed electric motor drives will be exhibited, at least two of which employ pneumatic means of regulation. One pneumatic control operating under 60 to 100 psi, is positively positioned by a piston having both sides under working pressure and regulated by a pilot valve under 3 to 15 psi signal pressure. This system not only permits remote manual speed control, but offers regulation of a variety of dependent speed functions, to maintain speed constant with, or proportional to pressure; or speed regulation with respect to temperature, liquid level, rate of flow, or even conveyor delivery of dry materials.

One exhibitor will reveal a patented line of coordinated pumps and motors which offer new possibilities in the transmission of power through hydraulics. Up to three motors may be driven from a single pump, the motors affording high torque and high horsepower. A selector valve provides complete speed variation and control from the positive displacement pump.

A widely-known manufacturer of electric switches is bringing out a series of newly designed plug-in control centers for power distribution in industrial plants and commercial buildings. A manufacturer of lighting fixtures will disclose innovations in the illumination of work centers. Another well-known source will offer a new line of socket type welded pipe fittings, which includes joints for tubing; these are now required because of extreme pressure and temperature conditions in advanced equipment design.

Model gas turbine, a cut-away steam turbine, a new line of electric motors, a line of fans and blowers, as well as unit heaters, will be shown by another well-known manufacturer. As an important feature, this exhibit will be staffed by engineers, available to discuss with visitors the broader aspects of gas or steam turbine problems, air handling questions, electric motor and control apparatus.

An innovation at the exposition destined to interest public utility and power station operators, as well as manufacturers and users of electric motors, generators, transformers, cables, insulators and all types of electrical equipment, is the first comprehensive line of instruments designed specifically for DC over-potential testing. This equipment represents a field of interest in which considerable investigation has been carried out, and which offers an alternative to AC over-potential testing in both production and maintenance work. Though not yet accepted as standard practice by the electrical industry, the first offering of a line of commercial equipment in its class is of high technical interest.

Among items of special interest to be

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exhibited by well-known manufacturers is a motor rotation and phase tester for determining the direction of rotation of electric motors before putting them on the line, and also to determine the phase rotation or sequence of energized power circuits before cutting in equipment. There will be also a new temperature monitor for central stations, chemical processing or heavy machinery; positive acting, without need for scanning; versatile, and "maintenance free." There are, from still another source, a new time-delay relay, adjustable between ½ and 6 sec lag; and an engine-generator control that starts or stops the engine when the electrical load is cut in or cut out.

An established manufacturer of packaged boilers will show for the first time a boiler that is new in design and construction, introduced just this year. It is smaller in size than its predecessors, but with four-pass construction, affords 5 square feet of heating surface per boiler, assuring a minimum guaranteed efficiency of 80 per cent. Another exhibitor showing a line of "steam power packages" will feature a mercury-filled thermostat "unlike any other," which is not only accurate, but vibration resistant. Nor will visitors especially interested in steam fail to note a new tube expander with taper rolls of proper length to roll tubes closely spaced in thin tube sheets, as in packaged boilers.

A Valid Thought?

Have you ever felt regretful because most of your marvelous dreams never came true? Well, cheer up, brother engineer. Neither did your nightmares.

Engineer Shortage To Push Automation

The shortage of engineers will push automation — the automatic factory or office—into reality.

That is the opinion of David Rubinfien, supervisor of the Computer center at Armour Research Foundation of Illinois Institute of Technology, Chicago.

The need for engineering personnel already has been alleviated by computing machines, he pointed out.

"Quick-acting electronic calculators also remove from engineering activity a sordid routine that hounded many projects into failure in the past," he added.

Other factors Rubinfien saw in bringing about increased use of automation are the inability of humans to perform certain jobs with adequate speed; lack of safety in some industrial activities, and high cost of human participation in some factory areas.

As an indication that automation is approaching, Rubinfien said special purpose machines to perform all the operations necessary in completing a given product have been in existence for many years.

He referred to the canning and bottling industry, the highly automatic automobile production lines, and the continuous strip steel mills.

"While such machines are economical in never-changing product runs, it is difficult to see how they can apply to the varied production characteristic of most plants."

So far, these operations only continue the process of mechanization — the change from hand tools to machine tools, he said.

"Automation clearly goes further. It is a set of techniques for achieving the automatic plant, designed to minimize human participation in all of its phases."

A better answer lies in automatic control of separate and group processing. Automation would position both tools and work accurately according to a flexible set of instructions. The flow of work and tools between machines also would be electronically controlled, Rubinfien explained.

Another indication of automation is the use of computing machines in offices to perform detailed work rapidly, he said.

Office activities involve only elementary decisions when procedures are adequately detailed and complete. Such procedures are translated readily into programs for computers, he said.

He said if automation is to herald a second industrial revolution it will have to overcome obstacles of the cost of new equipment and further research; extensive product redesign in many industries for adaption to automation techniques, and the small number of skilled personnel in the field of automation.

The Computer center which Rubinfien heads is maintained as a section in the electrical engineering research department at Armour Research Foundation to solve problems from all fields where manual computation techniques cannot be applied.

Inquiries into servo-mechanism systems, machine tool control, and flight simulation for the evaluation of aircraft instruments currently occupy engineers and scientists at the center.

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Qualities of End Grain Praised

When you sit on a tree stump in your more rustic moments, you're on end grain wood.

End grain is the cut that supports the giant machines of the machine age and bears the traffic of a great part of American heavy industry, according to the National Lumber Manufacturers Association.

Small wood blocks with end grain surface—like that of the top of a tree stump — take the heaviest loads and shocks of modern industrial motion.

And end grain block floor bears the load and vibration of a generator rotor weighing 537,000 pounds in the General Electric turbine building at Schenectady.

Assembly lines for heavy tractors, graders and earthmoving equipment at the Caterpillar Tractor Co., Peoria, are floored with end grain wood blocks. Heaviest steel for battleships at Navy yards is handled over this type of flooring.

The blocks are widely used in the automobile, railroad, aircraft, farm machinery steel and aluminum industries. They are subjected to great heat and sparks from molten metal in foundaries, steel heat treatment plants, forge shops and glass plants. Tremendous loads on steel tires move over such floors for years without damage to the blocks.

"End grain wood is the closest thing to a permanent floor for heaviest duty that has ever been devised," the association said. "It doesn't break, shatter, crumble, dust off, or support combustion. You can build a fire on it but the fire won't spread. The blocks should be treated for moisture repellence and to prevent decay.

"Wood is non-conductive of heat or cold, and this property, together with its resilience, makes for foot comfort for plant workers. This 'easy on the feet' property explains its use also for armories, gymnasiums and even stables and elephant houses.

"Wood blocks once had wide use for street paving and highway bridges, and many such pavements are still in service."

End grain is a surface which has high resistance to indentation and abrasion, properties that give toughness and resistance to traffic wear. Yet, the cellular nature of wood is such that it has great resilience no matter how you slice it.

"This accounts for its value in industrial flooring, where toughness is required for serviceability and resilience is desirable for the comfort of workers," the NLMA said. "Only nature herself has been able to come up with a material capable of filling such a paradoxical role."

End grain blocks are manufactured by several competitive companies. Species most commonly used are southern pine, oak, gum and Douglas fir.

In some heavy industry plants, and particularly in lighter industries, maple and other exceptionally wear-resistant hardwoods are popular for flooring. These hardwoods are used in strip form.

Jet Engine Cells Are Largest, Quietest

The nation's largest—and quietest—jet engine test cells have been designed by Armour Research Foundation of Illinois Institute of Technology to test the Pratt and Whitney J-57, the most powerful jet engine in the free world.

The test cells are located at the Ford Motor company's aircraft engine plant at 7401 S. Cicero avenue, Chicago, where the J-57, which powers the supersonic F-100 Super Sabre fighter, went into mass production in April.

Equipped with an afterburner, a stove pipe-like device at the tail of the jet, the engine enabled a Super Sabre to set a world's record of just under 755 miles an hour last fall.

The test cells—six of them covering a total of 100,000 square feet—reach 78 feet into the air, or about as high as a seven-story building.

The tremendous roar produced by jet engines is reduced to a murmur by the test cells, according to Dr. Howard C. Hardy, assistant manager of the physics department at Armour Research Foundation, who headed the designing project.

"You could hold a conversation at the top of the exhaust stack," he explained. "And a hundred feet from the testing area there is no sound above background noise."

Two-thirds of the cost of the structures went into acoustical materials, Dr. Hardy said.

In addition to the six cells, there are three control rooms, offices, laboratories, and storage sections. Each control room is equipped to handle two engine-testing operations simultaneously.

The test cells were designed for the future when even the impressive J-57 may become obsolete. They are large enough to house engines twice the size of the J-57, Dr. Hardy said.

One of several designed by ARF, the cells are considered the least expensive and most efficient types of construction for controlling jet noises, Dr. Hardy added. They were rated by the Air Force as the most effective in the world.

Test cells consist of:

1. An intake section, including test stand and air vents, housed in a concrete room covered with acoustical lining;

(The ducts, measuring 20 by 20 feet —bigger than a subway tunnel—feed each cell's 350,000 cubic feet of air every minute at 15 miles an hour.)

2. An air tube or pipe imbedded in earth for mixing and cooling exhaust gases;

3. An exhaust section made up of a series of partitions of foot-thick concrete lined with 3 inches of sound-absorbing mineral wool, specially designed for high temperatures and high velocity.

Dr. Hardy explained that sound waves eminating from the jet engines are channeled through a series of 180-degree turns lined with sound absorbing material that kills about 15 decibels of noise at each turn.

"By the time the exhaust escapes to open air from the top of the stacks, sound is reduced from 160 to about 100 decibels—or about the same amount of noise encountered while flying in a small plane," he said.

To prevent the acoustical material from being destroyed, exhaust gases are cooled from 3,000 to about 400 degrees (F.) by mixing with water and air.

Dr. Hardy was aided in the designing project by assistant physicist, Britt J. Schweitzer. John H. Bonin, a supervisor in the heat-power research department, and Dr. George Fejer, a research engineer in that section, helped design the gas-mixing tube, an integral part of the test cells.

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WSE Personals

John F. Parmer, MWSE, has announced the opening of an office for continuing practice as a consulting and designing structural engineer, Room 612, 173 West Madison street, Chicago 2. His phone is FRanklin 2-4198.

Eugene K. Lydon, MWSE, became president of Great Lakes Dredge & Dock Co. effective Oct. 1. He has been associated with the company for nearly 30 years. **James E. Cahill,** MWSE, formerly a vice president of the company, and William P. Feeley, formerly president, retired effective the same date.

Robert E. Zinn, MWSE senior chemical engineer of the Vern E. Alden firm, who has been directing work for Monsanto Chemical Co., has been admitted to partnership in the Vern E. Alden Co. Walter C. Carlson and Richard J. Rasmussen were also admitted as partners.

David J. Fischer, MWSE, president of the David Architectural Iron Works, Inc., announces the opening of new offices and increased plant facilities at 1820 North Central ave., Chicago 39. The telephone is NAtional 2-7200.

Dr. Gustav Egloff, MWSE, attended the American Chemical Society meeting in New York, Sept. 12-17, where he presented a talk before the joint symposium of the Division of Chemical Marketing and Economics and Industrial and Engineering Chemistry, "Costs in Chemical Development." The title of Dr. Egloff's talk was "The Price of Process Know-How."

Dr. Egloff was co-chairman of the symposium before the Division of Industrial and Engineering Chemistry, Chemical Literature and Chemical Marketing and Economics. The symposium was called "Technical Information in Action."

To add to his many honors he has been elected to honorary membership in The Chemical Society of Japan. He also has been reelected to Council member-at-large of Cornell University, for a two-year term, and has been appointed a member of the Committee on Honorary Membership of the American Institute of Chemists. At the annual meeting of the German Institute of Petroleum and Coal being held in Essen, Germany, Dr. Egloff is receiving the Carl Engler Medal Award.

Waterway Locks Are Open to Visitors

Two of the seven locks and dams of the Upper Illinois Waterway are now open to visitors after being closed to public inspection for an extended period.

These are the locks at Brandon Road located at Joliet, Ill., and at Starved Rock at Ottawa, Ill.

The army corps of engineers has no immediate plans for re-opening for public inspection the other five locks at Lockport, Dresden Island, Marseilles, Peoria, and La Grange.

C. L. Bolland, in charge of the army engineer's Joliet Repair Station, said that in each case a fenced park area will provide the public opportunity to observe the lockage operations for barge tows. Fenced zones are safety measures. Inspection hours are from 8:00 a.m. to 4:00 p.m. everyday, including holidays.

The Illinois Waterway is the connecting link between Lake Michigan at Chicago and the Mississippi River at Grafton, a distance of 327 miles.

Operation of the locks and dams, the maintenance of channels, and the construction of authorized improvements in the upper 240 miles of the Illinois Waterway are duties assigned the Chicago District of the Army Corps of Engineers.

As there is a difference of 160 feet in the water levels of Lake Michigan and the Mississippi River it is necessary to provide an orderly raising and lowering of water levels so that barge tows can travel between the two points.

This action is accomplished at each of the seven locks variously spaced along the full distance. For example, at each lock a vessel enroute from Lake Michigan to the Mississippi is lowered one step on its way, the water level drop of these steps varying from 40 feet at Lockport to 19 feet at Starved Rock.

Visitors to the reopened locks at Brandon Road and Starved Rock observe the complete operation of "locking through". They can see a tow bound for Lake Michigan approach and enter the lock. They watch the closing of electrically controlled gates, the leaves of which vary in weight from 57 tons at La Grange to 315 tons at Lockport.

When gates are closed at both ends of the 600 feet long lock, the locked in area then containing the tow is filled by gravity flow with 19 million gallons of water (at Brandon Road). This raises the tow 34 feet putting it on a level with the segment of the waterway which runs to Lockport, 5 miles north where a similar operation is repeated.

Traffic tonnage and the number of ships on this inland waterway has greatly increased in recent years so that today there is considerable lockage activity.

The Illinois Waterway was first opened to traffic through its seven locks in 1933. First available total figure of tonnage through the locks was 5½ millions in 1939. By 1944 total tonnage rose to 7 millions, and increased to 17 millions by 1952. Army engineers anticipate the total for 1953 will reach 20 millions. Traffic over the Cal-Sag Channel in 1953 neared 4 million tons. It is estimated that with completion of the Cal-Sag widening project the tonnage will jump to 9 millions in the Cal-Sag Channel.

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Case Institute Serves Community

Case Institute of Technology is once again making its research facilities and talent available to the community by undertaking a research program on industrial waste disposal in the Cleveland area. The wide scope of the program is intended to produce results applicable to the entire metropolitan area.

Local companies supporting and participating in this program to date are: the American Steel and Wire Division of the United States Steel Corporation, The Cleveland Electric Illuminating Company, Harshaw Chemical Company, Industrial Rayon Corporation, Jones & Laughlin Steel Corporation, Republic Steel Corporation and the Sherwin-Williams Company.

The program has been endorsed by the Committee on Industrial Wastes of the Cleveland Chamber of Commerce and the Ohio Department of Health.

Directing this carefully planned study will be Professor George E. Barnes, head of Case's Civil Engineering and Engineering Mechanics Department. Working with Professor Barnes will be Dr. Leon W. Weinberger, assistant professor of civil and sanitary engineering.

According to Professor Barnes, the focal point of this research project on Cleveland's industrial waste disposal will be to crystallize the city's and industry's thinking on what the objectives should be in this area. Case's facilities and previous studies in this field place it in an excellent position to aid in the development of objectives, definitions and methods.

The findings will reflect Cleveland's conditions and help in the formulation of local policy in these matters.

In outlining the program Professor Barnes said it will be primarily concerned with the pollution potential of industrial wastes in metropolitan Cleveland and the status of industrial waste disposal in this area. Later phases will take up studies on the effect of various wastes on unit treatment processes, such as sedimentation, areation and sludge digestion.

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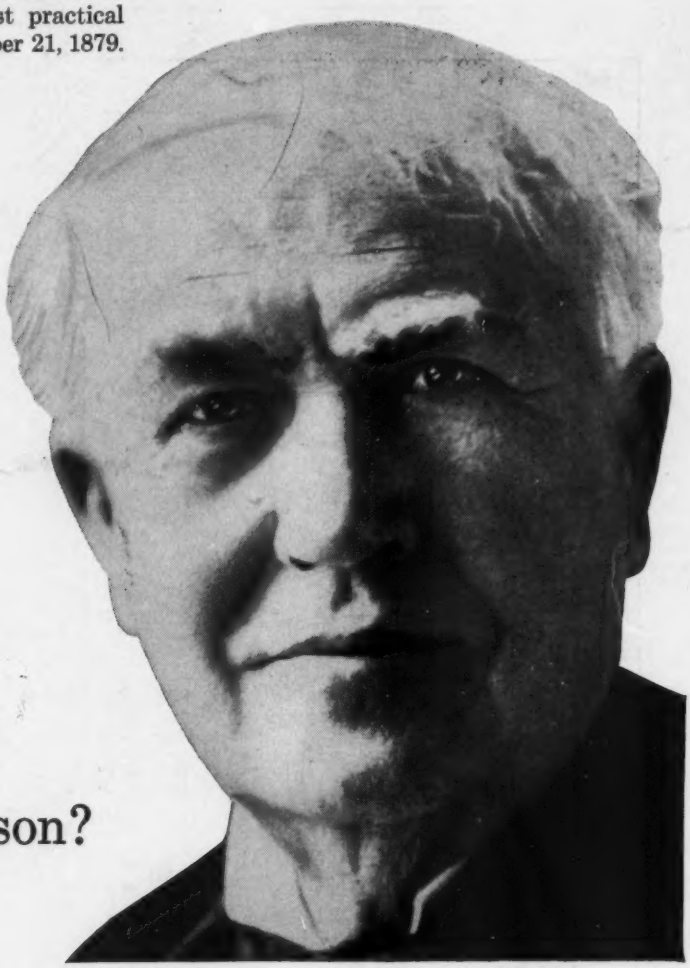
In celebration of Light's Diamond Jubilee, we honor Thomas A. Edison, whose first practical light bulb was tested successfully October 21, 1879.



What next, Mr. Edison?

If you were alive today, you'd see a future for electricity even greater than its past.

The industry you started with a single light bulb back in 1879 is still moving at a breath-taking pace. For example, we at Commonwealth Edison expect the use of electricity to at least triple in the next 25 years.

The challenge to men with eager, exploring minds like yours is still as great as it was in your day. The problems are different now, but the need for big men with big answers is the same.

If you were alive today, you'd see tremendous vistas of opportunity for utility engineers.

Opportunities in atomic power . . . in high-voltage transmission . . . in new industrial techniques for metals, chemicals, and plastics . . . in new farm equipment . . . and perhaps in ideas so new we haven't even guessed at them yet.

25 years from now, some of these ideas will have taken a place in our lives beside your light bulb. Which one will be most important to mankind? Which one will be first?

What next, Mr. Edison?

1879—LIGHT'S DIAMOND JUBILEE—1954

COMMONWEALTH EDISON COMPANY

PUBLIC SERVICE COMPANY

PIONEERS IN PROGRESS FOR OVER 66 YEARS